Implementing Computerized Tracking at a Community Health Center: Challenges and Solutions

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ABSTRACT

A computerized tracking system for both preventive care and chronic disease tracking was implemented at a community health center, using a PC based local area network interfaced with a mainframe scheduling and billing system. Initial database construction used downloads of historical billing data, but ongoing database maintenance is accomplished by using an optical mark-sense scanner to construct both billing and clinical tracking files from custom-designed encounter forms. In this way, expanded clinical data is collected with an actual reduction in manually keyed data, reducing the ongoing cost of the system.

INTRODUCTION

The goal of a completely computerized medical record in ambulatory care is frustrated by both technical and financial barriers [1,2]. However, computerized tracking may offer a partial solution to the information needs of clinicians in managing their ambulatory care patients. Tracking programs are designed to augment the traditional paper medical record, capturing key clinical data from the myriad of patient information generated during an ambulatory care visit. Tracked data can include diagnoses, risk-factors, medications, allergies, preventive care, screening, referral and consultation. Users can define databases to collect specialized data for information intense conditions such as from prenatal care or HIV infection, or high volume procedures such as childhood immunizations.

Computerized tracking programs have been shown to address many of the health care services problems faced by patients of Community Health Centers (CHCs). Compared to typical private practices, the patients who seek care at CHCs are frequently poor, less well educated and underinsured or uninsured, and are less likely to obtain follow-up care, preventive care and screening procedures [3]. In addition, CHCs frequently employ a large number of part-time clinicians as well as physicians-in-training, and tend to have a high staff turnover rate, further reducing continuity of care and increasing the chance that patients will be lost to follow-up.

Computerized systems can identify and reschedule patients who do not return for appointments and remind clinicians of patients needing follow-up care [4,5]. Gender and age-specific decision rules can generate individual patient preventive care and screening profiles [6,7] and these data summaries can remind clinicians to offer overlooked preventive care and cancer screening [8-11]. Patients can also be targeted for mailed educational interventions to further increase preventive care [8,12,13]. Database analysis may be an invaluable source of both individual clinician performance feedback and center-wide quality improvement data [14]. Finally, such data may even be used to support population and community health care initiatives. The sum of these efforts may help to reduce the excessive morbidity and mortality experienced by poor and minority patients [3].

Unfortunately, the increasing number of medically indigent individuals coupled with reduced government funding to CHCs makes the cost of tracking system implementation and maintenance a crucial consideration. Efficient use of existing resources is essential and current data sources such as billing systems may support tracking data requirements [11,15]. For example, much of the demographic data and many diagnoses needed for tracking patients are already collected for billing

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purposes, and to avoid data entry duplication, the billing and tracking systems can be closely linked [10]. However, since the data requirements for clinical tracking are more extensive than those needed for billing, the ongoing costs of tracking, specifically the costs of data entry, may ultimately determine the viability of computerized tracking in CHCs.

One approach to this dilemma is to collect tracking data on the clinical "encounter form." This form has been traditionally used to record data necessary for billing patients or third party payers. The form can be expanded to include additional clinical data while continuing to collect billing data. Linking the tracking and billing system also assures that clinically important data from every patient visit is collected by the tracking system. Finally, a modified encounter form lends itself to a less expensive form of data entry such as mark-sense optical scanning, frequently used to correct standardized tests and thus familiar to clinicians.

We describe the implementation of a clinical tracking system at an urban community health center. The ultimate goals were to create an administrative and electronic structure that used data already collected within the center, updated both tracking and billing databases automatically, and extended the collection of clinically relevant data. The system could not significantly increase operating costs or disrupt clinical practice, so optically scanned encounter forms were used for data collection and entry to both billing and tracking systems.

METHODS

Setting

Reynolds Health Center (RHC) is an urban community health center operated by Forsyth County, providing 70,000 ambulatory care visits annually to poor, predominantly minority patients (70% African American) of Winston-Salem, NC. The center is staffed by nurse practitioners, physician assistants, and resident and faculty physicians from Bowman Gray School of Medicine in all primary care departments and a number of specialties. Pharmacy, laboratory and x-ray services including mammography are offered at the center, but initial implementation of computerized tracking was limited to the adult medicine department.

Encounter Form

The clinical encounter form was expanded and modified from the traditional check-off type form to a double-sided mark-sense form, requiring clinicians to fill in rectangles corresponding to clinical data. The form lists 14 CPT visit codes for new and established patients, the date of onset of primary diagnosis, an extensive CPT list of common procedures as well as sections for risk-factors, allergies, and referrals. The 100 most common diagnoses and corresponding ICD-9 CM codes are listed, with two mark-sense columns corresponding to primary and secondary diagnoses. Spaces are reserved for "write-in" diagnoses and procedures not listed on the form. In addition, preventive care, screening and monitoring studies were added, with three mark-sense columns to denote if a procedure was "ordered or performed," "refused" or "not applicable." A section for patient follow-up specifies options for follow-up intervals from less than one week to one year. The right one inch margin of the front of the form was reserved for printing bar code and text. For billing purposes, minimum criteria for acceptable completion and scanning of the completed encounter form are a single visit code, a single primary diagnosis and date of onset of primary diagnosis. Any number of secondary diagnoses, procedures, allergies and referrals are acceptable. Preventive care and screening procedures may be marked or left blank, depending on whether they are addressed by the clinicians during a particular visit.

Network Configuration and Mainframe Interface

The tracking local area network uses a dedicated microcomputer as fileserver running Novell netware via ethernet cabling to eight PCs within the adult medicine clinic. The network is linked to the county's mainframe billing and scheduling computer system through two asynchronous communications servers and a standard telephone line. Patient demographic and insurance data are keyed manually into the mainframe as patients register at the health center, and these data are downloaded to the network fileserver the next day. When patients check-in at the adult medicine clinic, an account number is assigned by the mainframe. A program residing on the county's mainframe prints patient name, medical record number, account number, financial codes and clinician name in text, and bar-codes the numerical data on the encounter form, which is then clipped to the medical record. After the clinic session, the clinician returns the encounter forms, marked with diagnoses, procedures and other clinical data, to the registration area to be scanned.

Optical Scanner

A Scantron 8400 mark-sense scanner with bar-code and ink-read options, is used to read up to 2400 completed forms per hour. A program running

under the MicroSoft Windows environment provides the user interface to the scanner. The barcoded medical record and account numbers link the encounter form data to the tracking and billing systems respectively. Information and errors are quickly brought to the operator's attention and the operator may enter the ICD-9 or CPT codes for write-in entries, or cancel the entry of that particular form. Error checking for minimum billing data requirements is performed at the scanner and more advanced error checks reside on the PC program. The PC then saves the file in ASCII format for import to the tracking and billing systems.

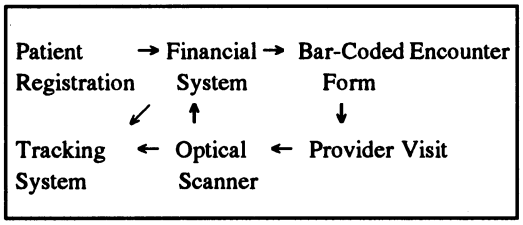

Figure 1 Data capture and transfer in the tracking and financial systems.

Tracking Program

The Med/Track clinical tracking program (Clinical Software Inc., Hingham MA) is a relational database written in "Clipper" language. The Med/Track Import program sorts and maps fixed length files into specific patient records within the clinical tracking databases, facilitating tracking database construction from existing billing systems. The tracking program uses protocols for age and gender to generate preventive care history profiles. For chronic disease diagnoses, two tracking strategies can be employed. A specific clinical transaction such as a diagnosis of hypertension, for example, can be prospectively assigned a practice-specified follow-up interval such as six months, and the follow-up requirement is removed only when a patient returns within the specified interval. If the patient does not return, the record is flagged on the patient summary screen and on periodic reports as "overdue for follow-up." Alternatively, the databases can be searched retrospectively using pre-established "compliance monitoring" criteria and thus all hypertensive patients who have not returned for follow-up within the past six months can be identified. Other clinical transactions such as medications, referrals, preventive care procedures and user-defined clinical databases can also be linked to a tracking interval. All databases can be searched to create clinical reports, or specific search files may be used to print labels or mail-merged letters to be mailed to patients.

Data security is maintained by two passwords required to log-on to the network, with higher-level passwords necessary for access to report functions. Diagnoses and other transactions may be classified as "sensitive," and higher level passwords are required for access to "sensitive" data.

RESULTS

Initial Clinical Database Construction

A dictionary of almost 15,000 ICD-9 CM and CPT codes with a short text description of the corresponding diagnoses and procedures was imported from the county billing system master file into the fileserver. The demographic data download from the billing system through the Med/Track Import program comprised data for over 42,000 patients and a subsequent file of more than 130,000 diagnoses and procedures was downloaded to the network server completing the initial tracking database construction.

Billing and Tracking Database Maintenance

Registration personnel noted that the new method of printing bar-coded encounter forms, rather than stamping with an embossed card, actually improved patient flow and shortened waiting times for patients. Technical difficulties were encountered with optical scanning of the forms, however. The scanner ink-read function proved unreliable and the high error rate led us to require clinicians to use pencils to complete the forms. The scanner also sensed stray or non-existent marks, resulting in false billing data. To check scanner reliability, a program was written to perform side-to-side comparisons of doubly scanned forms and initially demonstrated discordant readings for 10 of 78 forms. Scanner repair eliminated the discordance, but double scanning and sample manual data review is now routinely performed to detect scanner errors. Only rare problems were seen with scanner reading of the bar-code data.

Errors in the clinical data entered on the encounter form were also detected, predominantly problems meeting minimum billing criteria such as clinicians marking more than one visit code or primary diagnosis, or marking an invalid primary diagnosis onset date. After initial installation and training, forms with clinical data errors were returned to providers with the type of error noted, and correct form completion rates improved rapidly. Clinical

data error rates reviewed two months after system implementation continue at approximately 10 percent, while write-in diagnoses and procedures account for approximately 5 percent of forms not read by the scanner. Thus 85% of encounter forms are now read by the scanner without errors or need for correction. Assessment of the accuracy and validity of the procedure data in the downloads and the use of additional data options on the form such as preventive care procedures, risk factors, allergies and referrals is currently being performed by comparing traditional medical record notes to the clinical data in the tracking system. The results of these reviews will be reported to clinicians in the form of feedback, and serve to improve both data collection accuracy and performance and completion of preventive care procedures.

Costs

Total hardware, software, and installation costs were $148,000, but this includes much of the cost for installation in the pediatrics, obstetrics and gynecology, radiology and medical records departments. The marginal cost for the tracking system is difficult to estimate since we anticipate a decrease in personnel costs for the existing billing system, and may realize a net increase in revenue from improved provider completion of the encounter forms. Furthermore, plans for network applications extend beyond computerized tracking to knowledgebase applications, clinical decision support and clerical support. The custom designed form cost $640 for initial layout, and are currently purchased at $126 per thousand. One full-time computer engineer supported technical and program requirements, but no additional administrative or clerical personnel were needed for the implementation or continued function of the system.

DISCUSSION

Computerized tracking is a valuable tool to assist primary care clinicians in managing an increasingly difficult and complex ambulatory care practice. By providing rapid accessible clinical and preventive care summaries as well as reports on patient compliance with follow-up, computerized tracking may free the clinicians to concentrate on the immediate daily needs of patients. Performance feedback can highlight the areas where individual clinicians provide excellent care and pinpoint problems where more clinical and administrative efforts should be focused. With the advent of practice guidelines, primary care clinicians will need data systems more "user friendly" than traditional medical records to assess their clinical performance, and allow them to design and implement strategies to address deficiencies. Feedback may be especially useful in many CHCs with academic affiliations such as ours by expediting disease-specific review of resident physician clinical performance, facilitating faculty review of resident physicians' diagnostic and therapeutic decisions, as well as patterns of consultation. Finally, the database may be a convenient sampling frame for the increasing administrative requirements of quality review and monitoring, and aid in efforts to improve health care delivery systems in the community.

As important as assisting clinicians, CHC patients may benefit from systematic tracking. Because medically indigent patients continue to face high-costs and other barriers to health care access, CHC clinicians must have tools to address non-compliance with follow-up and to target at-risk or high-risk populations for interventions before serious medical sequelae develop. With the ability to identify these patients, educational interventions, specifically oriented to low literacy populations, may be tested and refined using the tracking database to measure effectiveness [12,13,16].

The challenge of implementing computerized tracking at a time when health centers are facing severe budget constraints is daunting, yet much of the data needed for tracking is collected within other computerized systems at these centers. Linking the billing and clinical tracking systems eliminates the need for clinicians to individually track and identify patients for follow-up and captures preventive care and screening information from every patient visit. The additional data needed for tracking mandated a new method for data entry and optical mark-sense scanning of the clinical encounter forms provided a way to reduce the volume of manually keyed data for the billing system, and clinically important (but financially irrelevant) additional data for the tracking system. The encounter form contains a limited the number of diagnoses, procedures, allergies and referrals, so write-in diagnoses and procedures continue to be used, albeit for a small percentage of patient visits.

Implementation of the modified encounter form did not disrupt the practice of established clinicians, and does not require a computer-clinician interface. RHC clinicians quickly adapted to the new forms in part because the new encounter form was designed to closely resemble the old form. The high success rate for "first pass" scanning is a result of feedback to clinicians since forms were returned

immediately for error correction. During informal surveys, the method of data organization within the form was criticized initially by experienced clinicians, but new physicians had no objections to the form design.

In summary, computerized tracking systems for chronic disease and preventive care can be implemented in CHCs without dramatically changing clinical practice, and ongoing costs can be minimized using existing computer systems and optically scanned encounter forms as a source of data. Our efforts to date have been limited to adult medicine, but implementation in the pediatrics clinic is underway. Encounter form design for obstetrics and gynecology clinic, with integration of the county's WIC program is in progress. Through the use of the Med/Track Import program, we are now building a link to the center pharmacy for medication and allergy data downloads. Selected laboratory and radiology data will be imported after "filtering," to target critically important results for tracking purposes. Allowing secure off-site access will be the among the future challenges for CHCs with the goal of improving patient management, coordination of care and eventually health outcomes in disadvantaged populations.

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